



BACKGROUND ART

Fig. 1

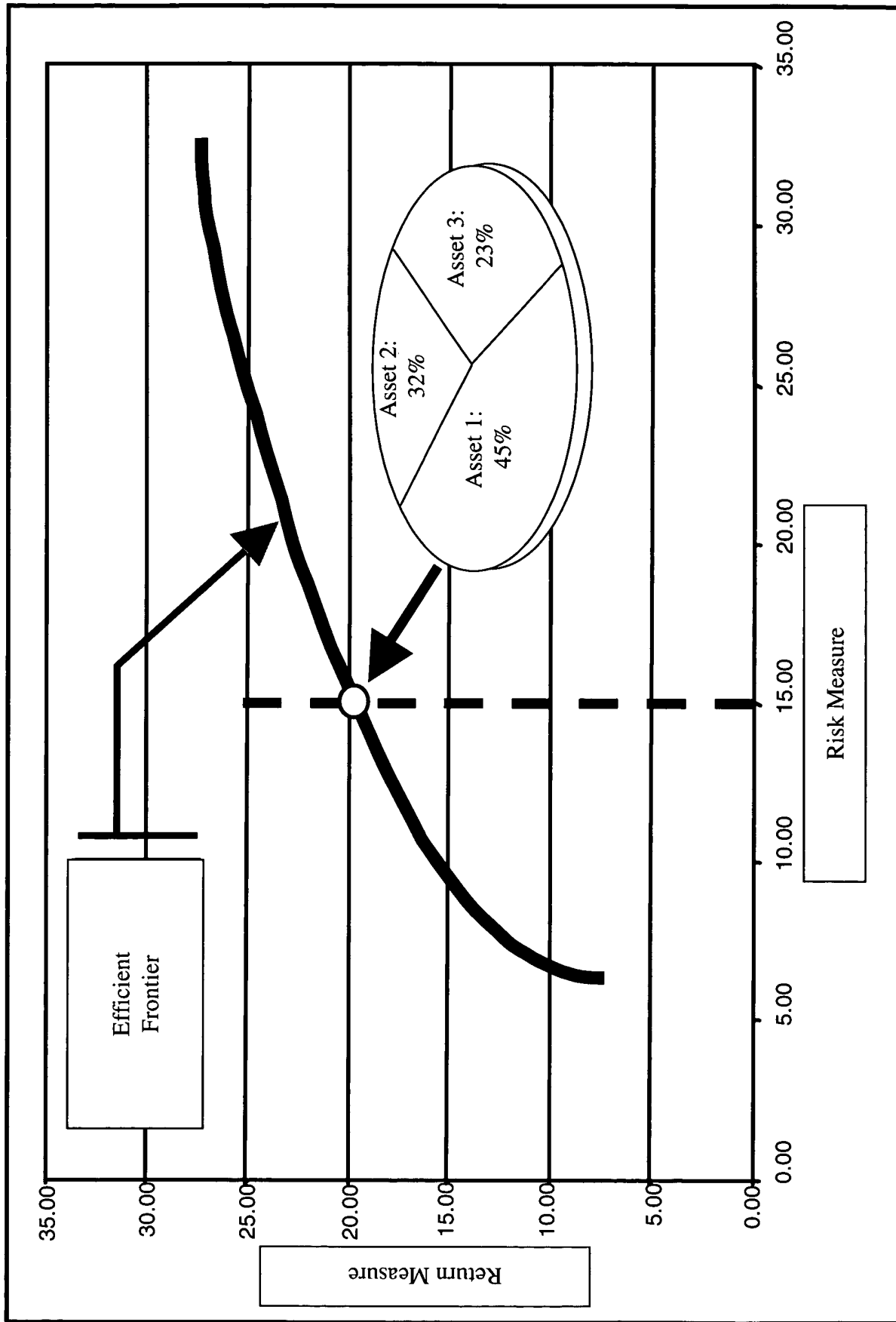


Fig. 4

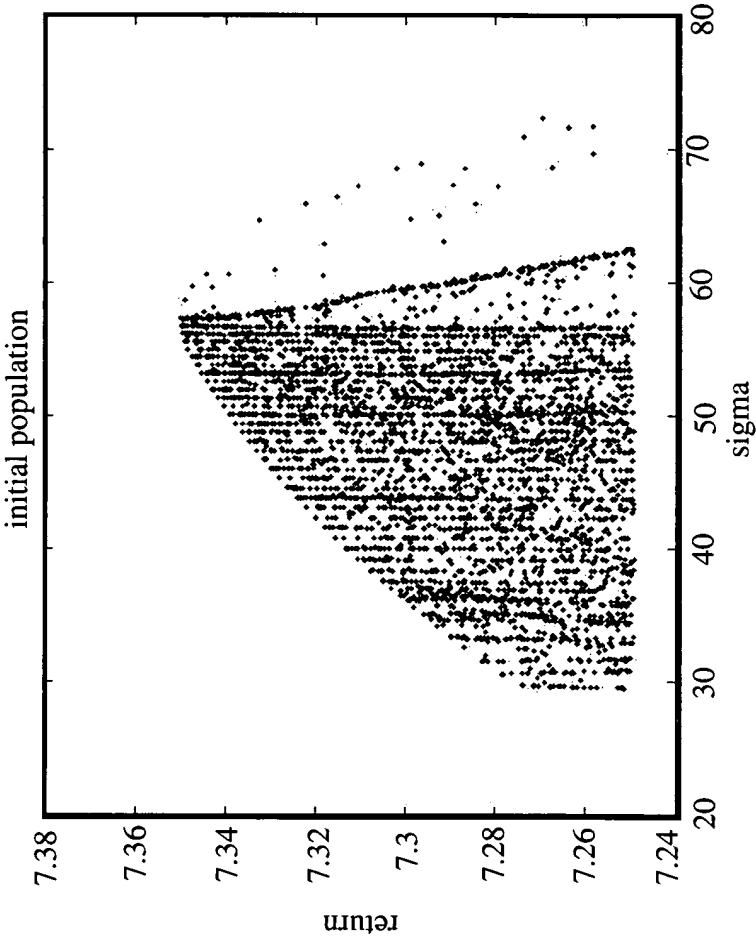
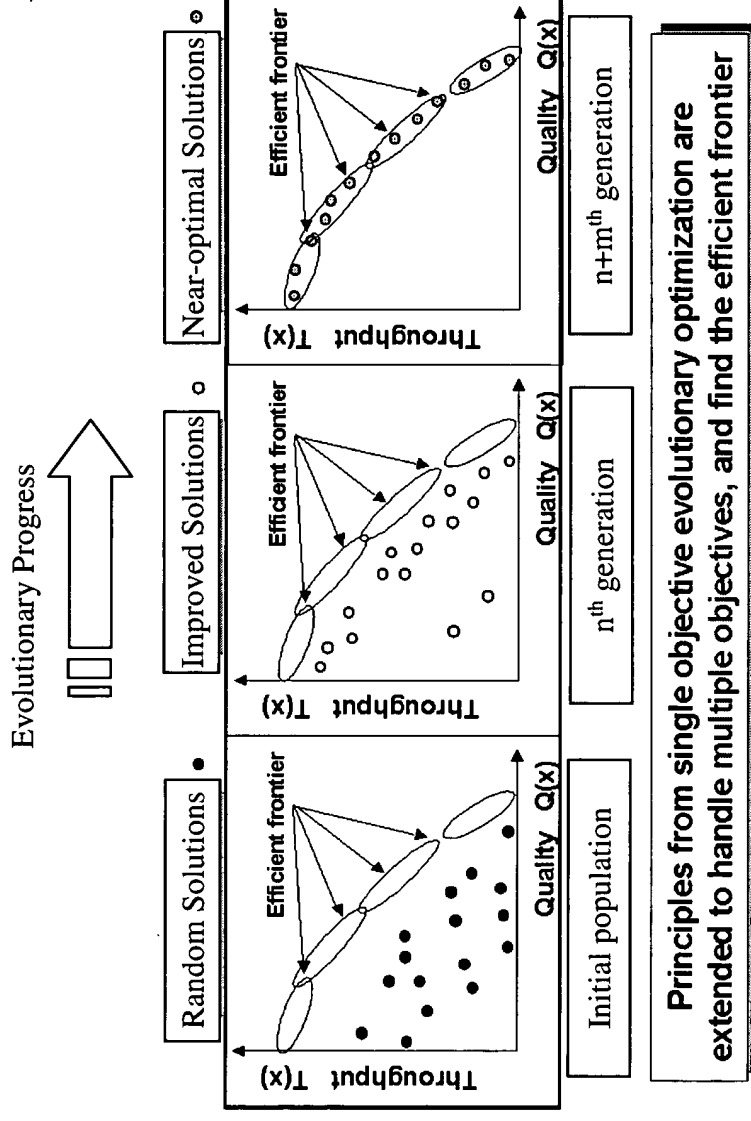


Fig. 5



# Pareto Sorting Evolutionary Algorithm (PSEA)

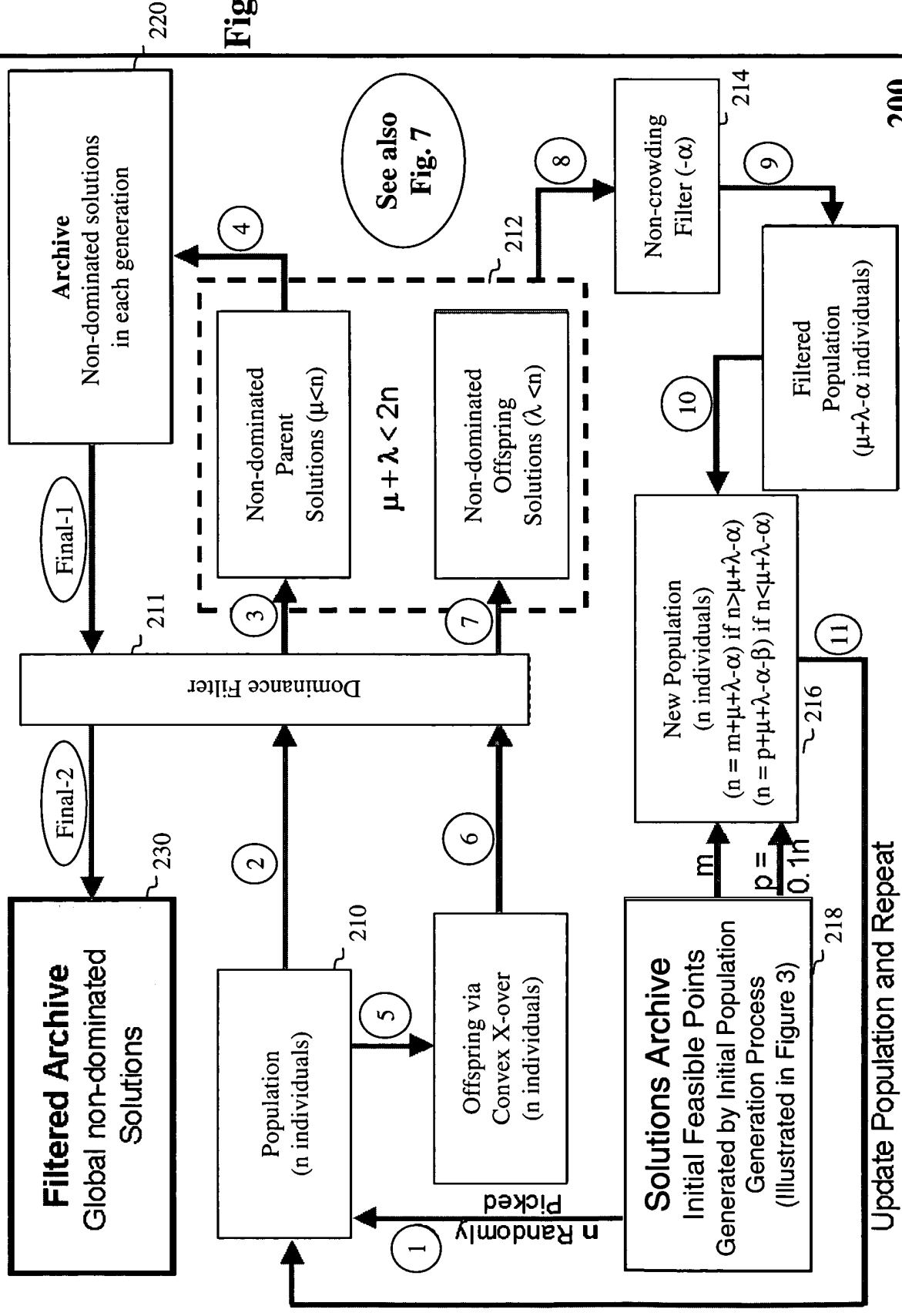
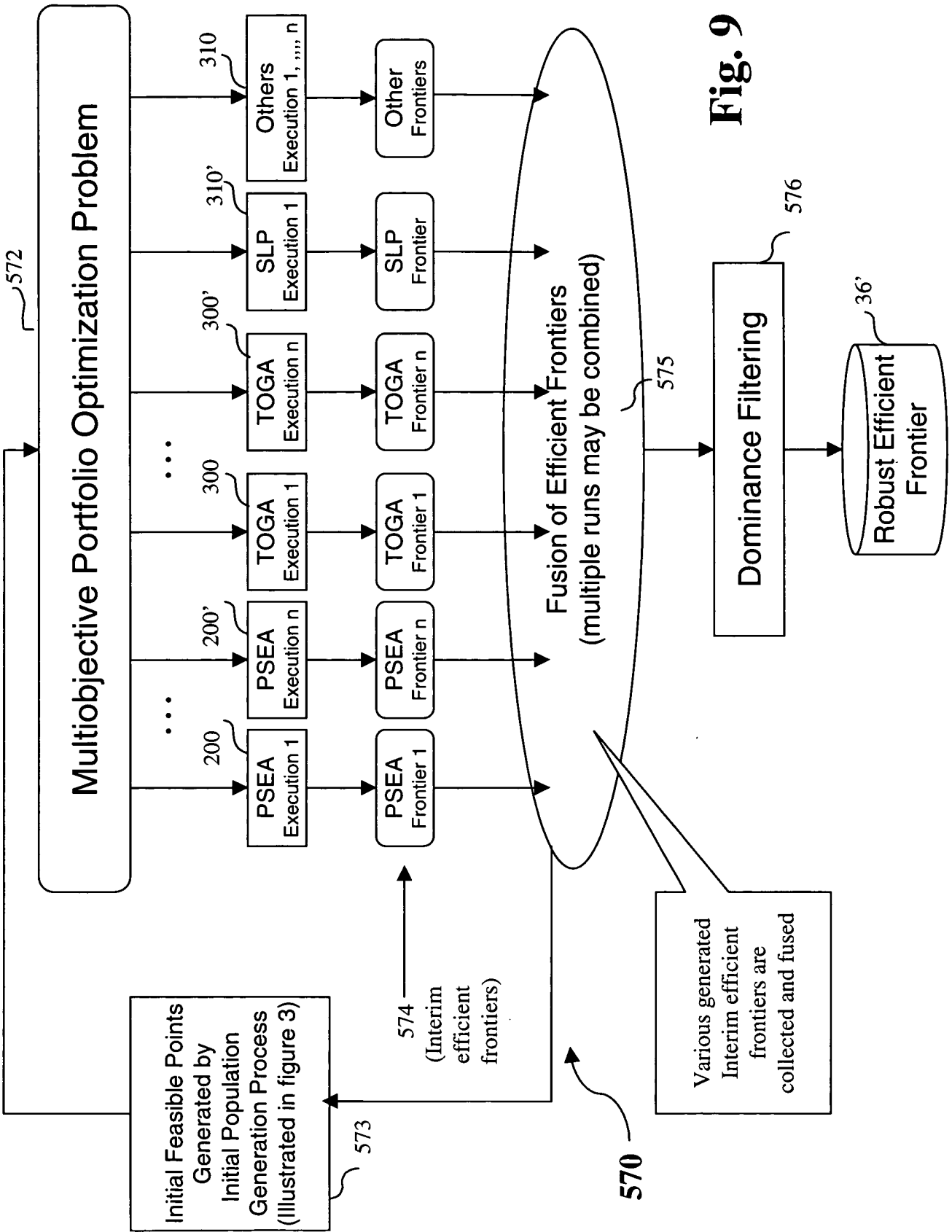
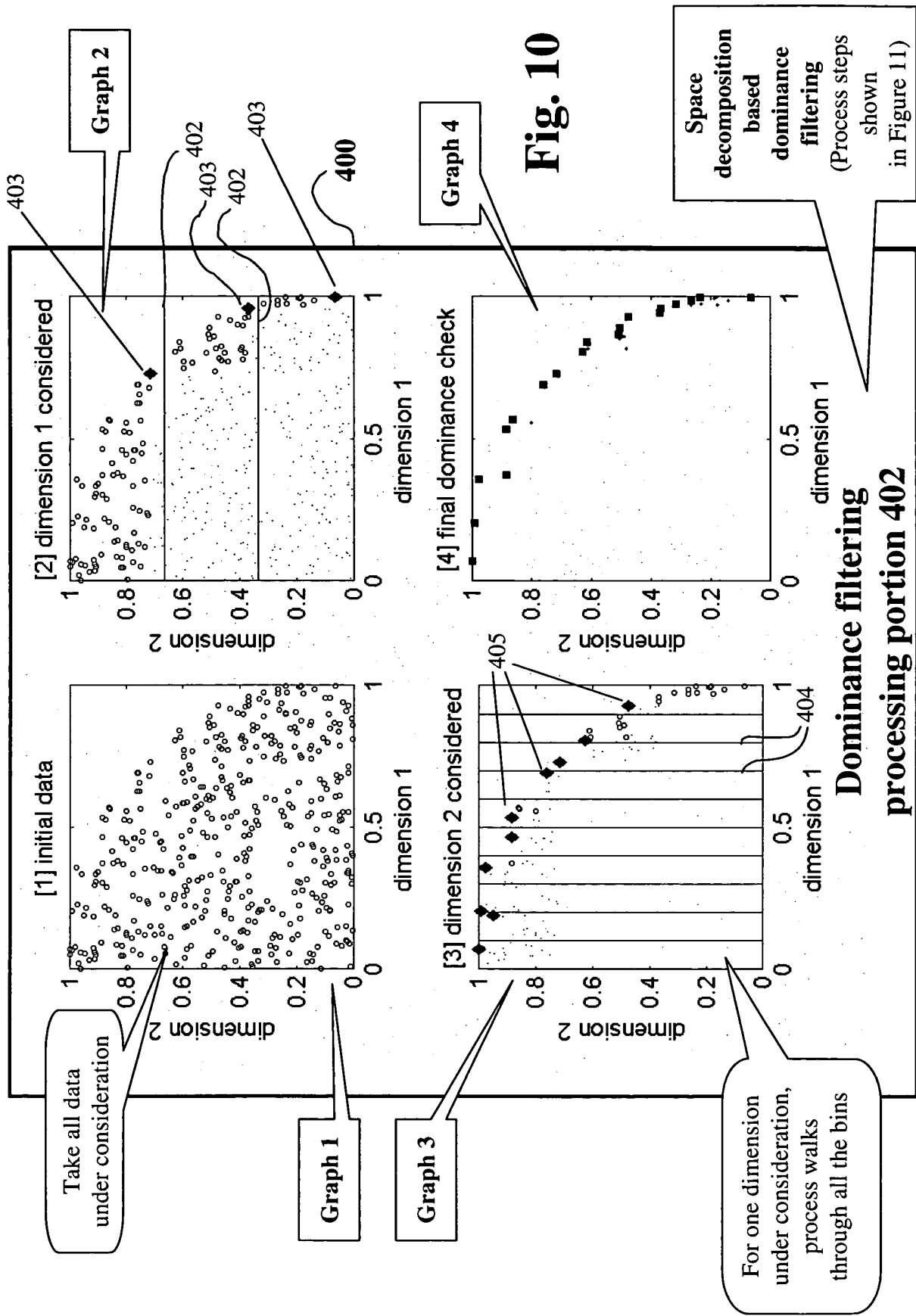
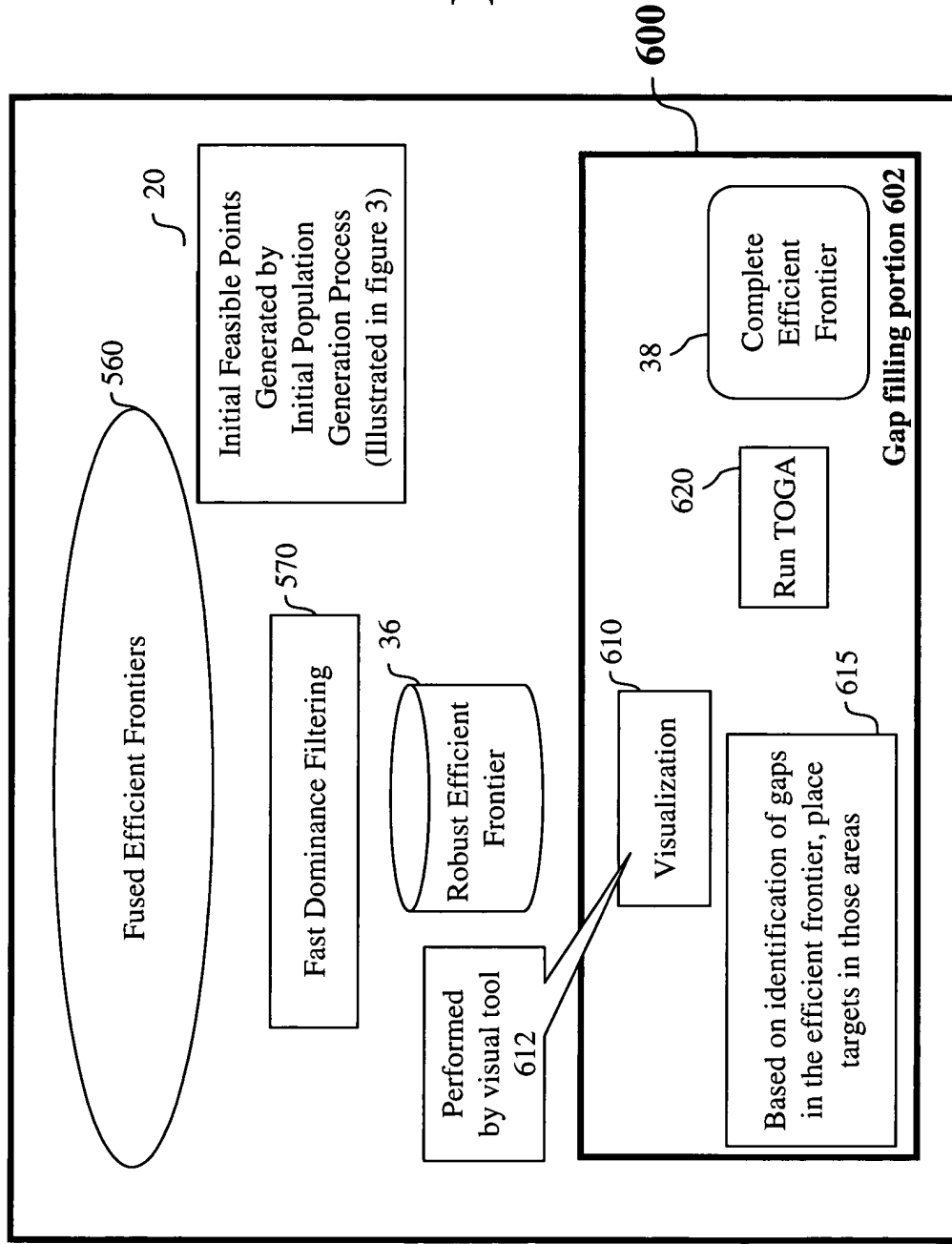


Fig. 6



**Fig. 9**





**Fig. 12**

**Process to interactively fill any gaps in the identified efficient frontier**

EXAMPLE OF PARALLEL COORDINATE PLOT

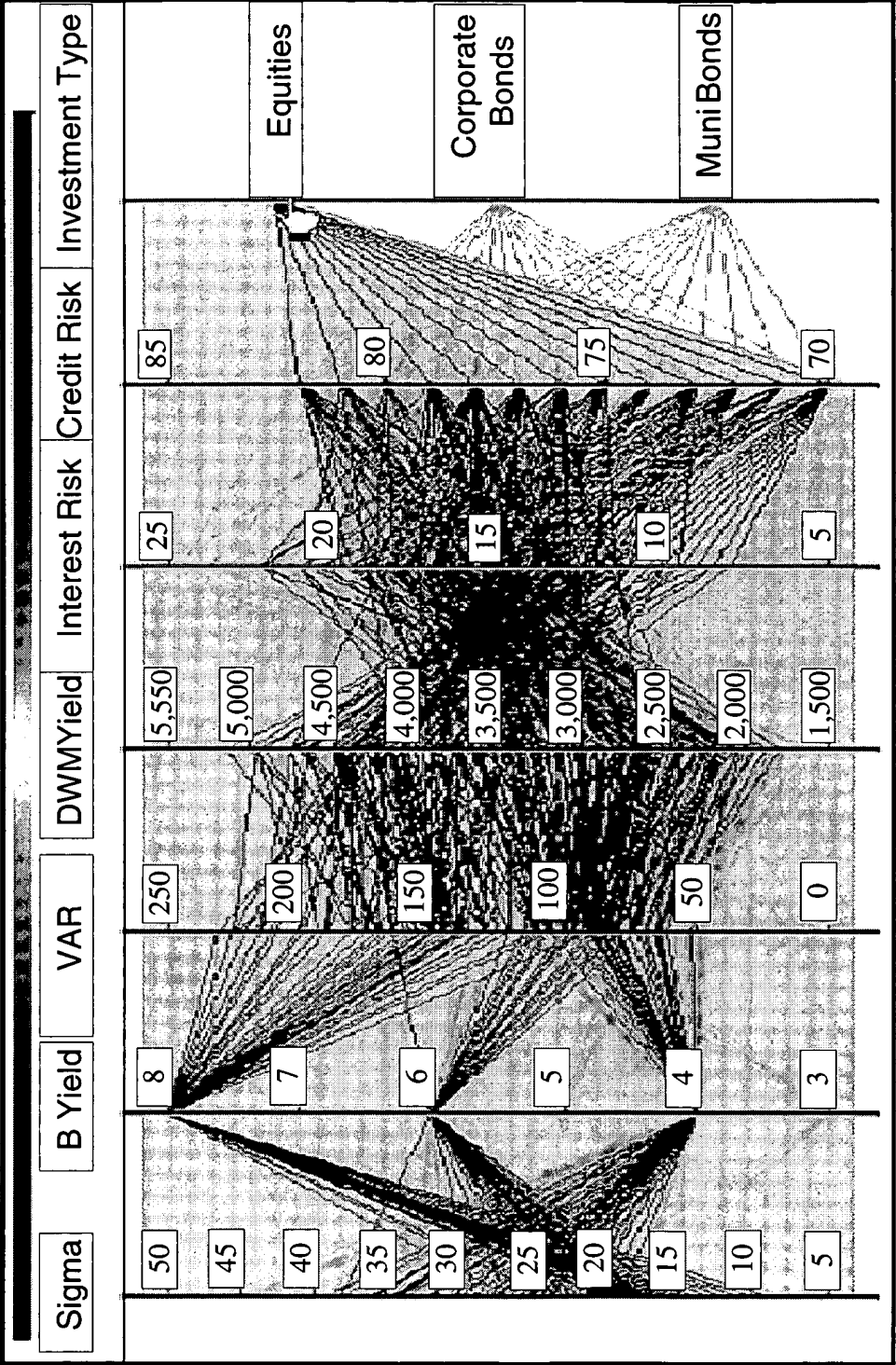
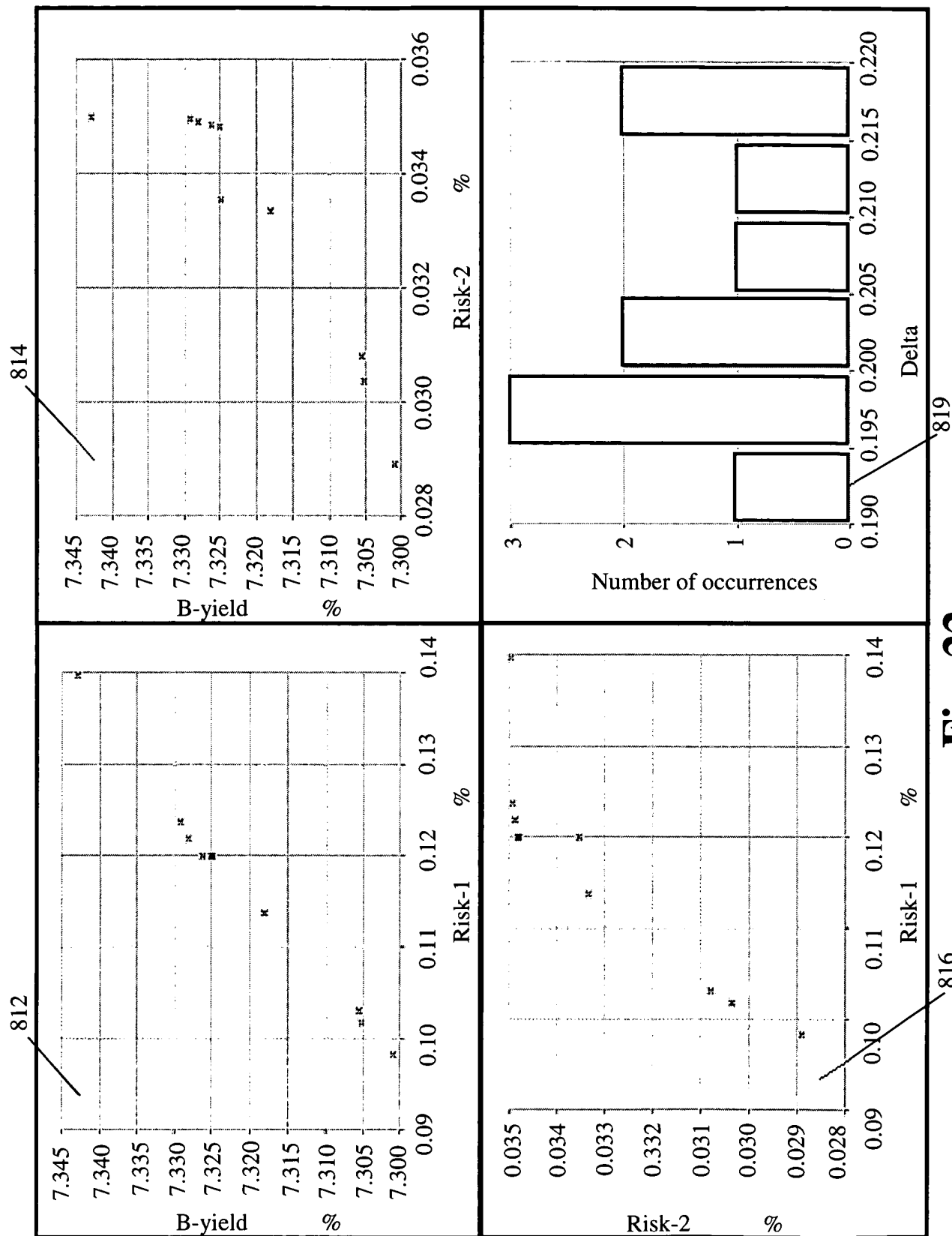


Fig. 14





**Fig. 22**

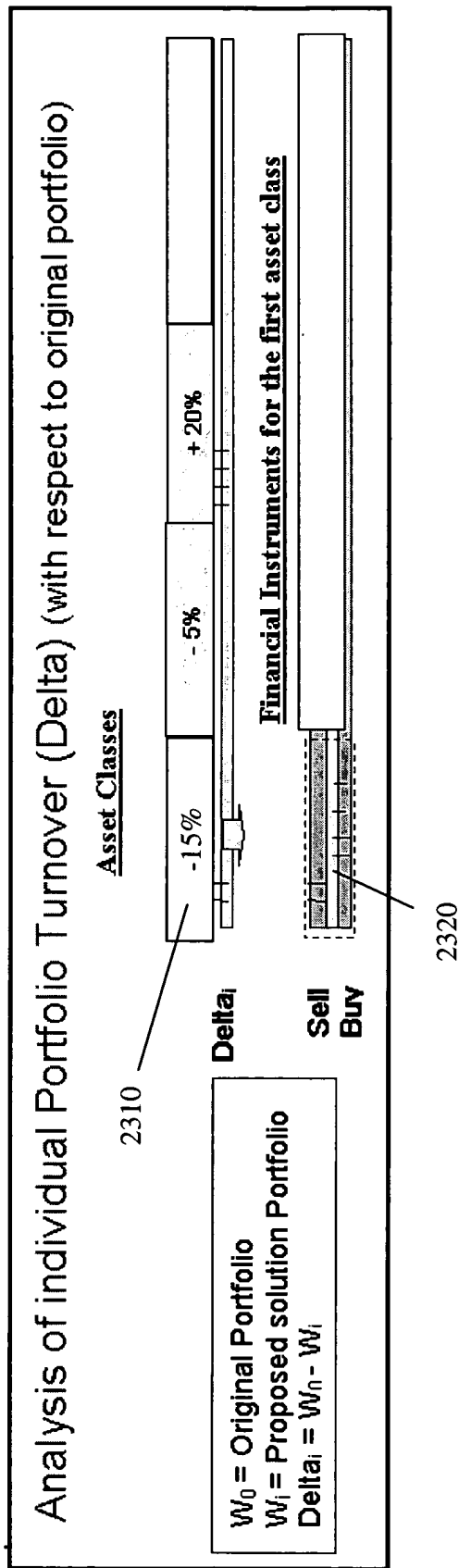


Fig. 23

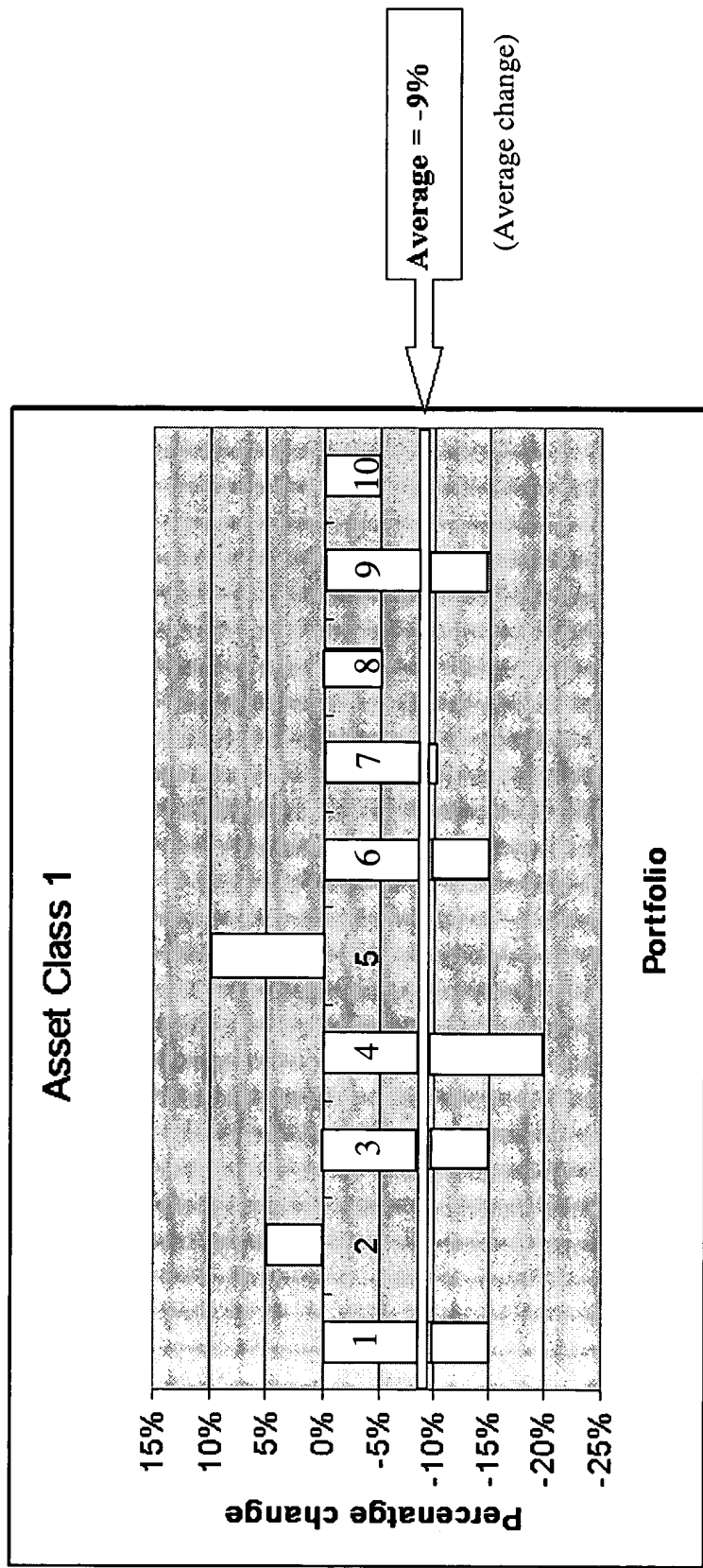


Fig. 26

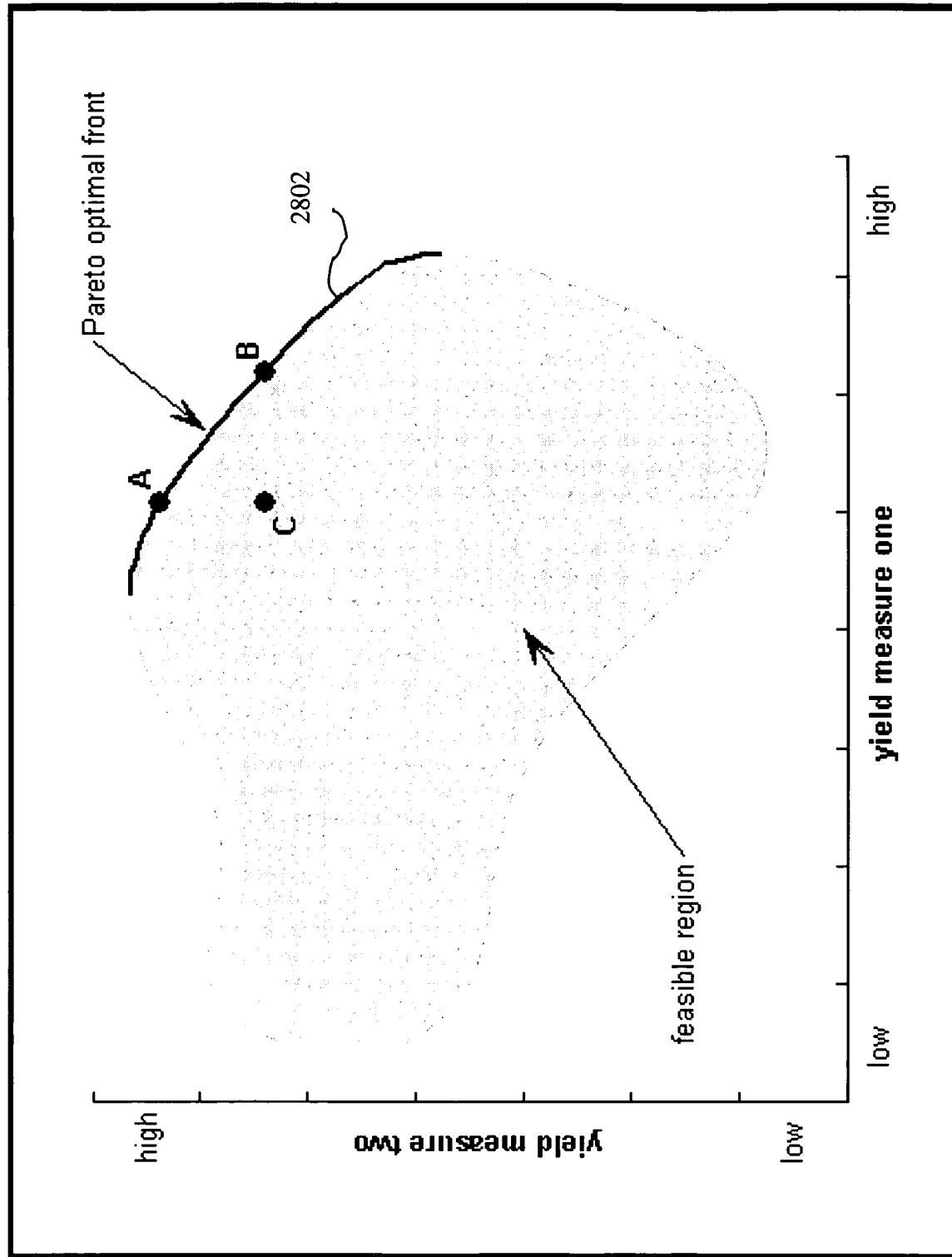
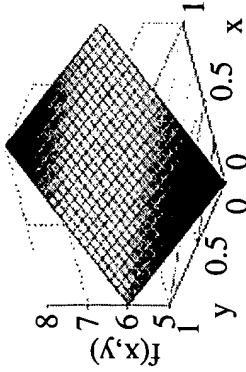
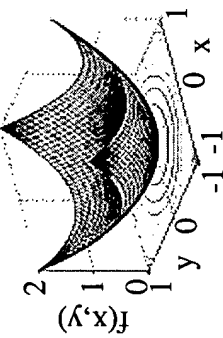
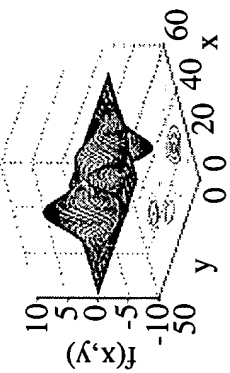


Fig. 28

Figure 34

Objective Functions

Graphic Visual	Word Description	Example Equation	GEAM
<p><b>Linear Function</b></p> 	<ul style="list-style-type: none"> <li>• Function is defined using linear equations</li> <li>• Straightforward math relationship</li> <li>• Easy to optimize</li> </ul>	$f(x, y) = 2x + y + 5$	<ul style="list-style-type: none"> <li>• Market value weighted yield</li> <li>• Duration weighted yield</li> </ul>
<p><b>Nonlinear Convex Function</b></p> 	<ul style="list-style-type: none"> <li>• Function is defined using a nonlinear equation</li> <li>• Functional gradients lead to single optimum</li> <li>• Harder to optimize</li> </ul>	$f(x, y) = x^2 + y^2$	<ul style="list-style-type: none"> <li>• Interest rate sigma</li> </ul>
<p><b>Nonlinear Nonconvex Function</b></p> 	<ul style="list-style-type: none"> <li>• Function is defined using complex nonlinear equations</li> <li>• Multiple local optima</li> <li>• Functional gradients are inefficient</li> <li>• Very hard to optimize</li> </ul>	$f(x, y) = g_1(x, y) + g_2(x, y) + g_3(x, y) + g_4(x, y)$	<ul style="list-style-type: none"> <li>• Interest rate sigma and VAR</li> </ul>